Energy Efficiency and Renewable Energy
Federal Energy Management Program

How to Buy Energy-Efficient Fluorescent Ballasts

Why Agencies Should Buy Efficient Products

- *Executive Order 13123 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency, including all models that qualify for the EPA/DOE* ENERGY STAR® *product labeling program.*
- *Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.*
- *As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy efficiency, while saving taxpayer dollars.*

Federal Supply Sources:

- Defense Logistics Agency (DLA)
  Phone: (800) DLA-BULB
  dscp103.dscp.dla.mil/gi/general/light1.htm
- General Services Administration (GSA)
  Phone: (817) 978-8640
  www.fss.gsa.gov

For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.
  Phone: (800) 363-3732
  www.eren.doe.gov/femp/procurement
- FEMP's *Federal Lighting Guide* and other resources provide helpful guidance on lighting projects.
  Phone: (800) 363-3732
  www.eren.doe.gov/femp/resources/lighting.html
- American Council for an Energy-Efficient Economy (ACEEE) publishes the *Guide to Energy-Efficient Commercial Equipment*, which includes a chapter on lighting.
  Phone: (202) 429-0063
  aceee.org
- Lighting Research Center's Web site has valuable information covering various lighting systems.
  Phone: (518) 276-8716
  www.lrc.rpi.edu
- E SOURCE publishes *Lighting Technology Atlas* (available to member organizations).
  Phone: (303) 440-8500
  www.esource.com
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
  Phone: (202) 646-7950

Efficiency Recommendation

Lamp Type	# of Lamps	Recommended BEF	Best Available BEF
Four-Foot and U-Tube Lamps			
T8, 32 Watts	1	2.54 or higher	3.00
	2	1.44 or higher	1.54
	3	0.93 or higher	1.06
	4	0.73 or higher	0.79
T12, 34 Watts	1	2.64 or higher	3.05
	2	1.41 or higher	1.53
	3	0.93 or higher	0.95
Eight-Foot Lamps			
T8, 59 Watts	2	0.80 or higher	0.81
T12, 60 Watts	2	0.80 or higher	0.80

Definitions

Ballast Efficacy Factor (BEF) is the ratio of the ballast factor (BF) to input watts; it measures the efficiency of the lamp/ballast system relative to others using the same type and number of lamps.

Ballast Factor (BF), also called Relative Light Output (RLO), is the ratio of the light output of a lamp(s) operated by a ballast, to the light output of the same lamp(s) operated by a reference ballast at rated current and voltage.

Where to Find Energy-Efficient Fluorescent Ballasts

The federal supply sources for energy-efficient fluorescent ballasts are the Defense Logistics Agency (DLA) and the General Services Administration (GSA). DLA sells fluorescent ballasts through its *Energy Efficient Lighting* catalog, available on its Web site. GSA offers them on Schedule 62-II, as well as through its on-line shopping network, *GSA Advantage!* Choose ballasts that meet the recommended levels.

When contracting or buying from a commercial source, specify or select a ballast BEF that meets the Efficiency Recommendation for that lamp type and number.

Buyer Tips

BEFs may not be indicated in manufacturers' literature, and must then be specified or requested. BEFs also can be calculated, by dividing Ballast Factor (BF) by input watts.

Only electronic ballasts meet the recommended efficiency levels. However, in rare applications where sensitivity to electromagnetic interference is a particular concern, magnetic ballasts may be preferred; several

federal agency guide specifications provide guidance on appropriate applications for magnetic ballasts.

The most efficient ballasts for four-foot T8, 32 watt lamps are "instant-start" ballasts, which may shorten lamp life in applications where lamps are turned on and off frequently; slightly less efficient "rapid-start" ballasts are preferable in these applications. Electronic dimming ballasts can be used to vary light levels.

Fluorescent lamp ballasts should have an RLO between 85% and 105% in most applications, to maximize light output, avoid reduced lamp life, and prevent unnecessary power consumption. Total Harmonic Distortion (THD) should be 20% or less, to reduce interference with electronic equipment. Current Crest Factor (CCF) should be 1.7 or less, to avoid reduced lamp life.

Definitions

Total Harmonic Distortion (THD) measures the degree to which the current wave shape is distorted from a sinusoidal wave,, expressed as a percentage.

Current Crest Factor (CCF) is the ratio of the peak lamp current to the root mean squared (rms), or average lamp current. CCF has a range of 1 and above.

Fluorescent Ballast Cost-Effectiveness Example

Performance	Base Model	Recommended Level	Best Available
Ballast BEF	1.09	1.44	1.54
Rated Lamp Output – 2 lamps	5300 lumens	5600 lumens	6000 lumens
Actual Light Output – Ballast + 2 Lamps[a]	4740 lumens	5020 lumens	5260 lumens
Input Power	82 watts	62 watts	57 watts
Annual Energy Usage	295 kWh	223 kWh	205 kWh
Annual Energy Cost	$17.70	$13.40	$12.30
Annual Energy Cost Savings – Ballast + 2 Lamps	–	$4.30	$5.40
Annual Energy Cost Savings – Ballast only	–	$3.00	$3.60
Lifetime Energy Cost Savings – Ballast	–	**$31**	**$37**

a) Not including fixture performance, which affects total light output from the luminaire.

Lifetime Energy Cost Savings is the sum of the discounted value of annual energy cost savings based on average usage and an assumed ballast life of 15 years. Future electricity price trends and a discount rate of 3.4% are based on federal guidelines (effective from April, 2000 to March, 2001).

Cost-Effectiveness Assumptions

Energy use and performance of a fluorescent lamp ballast depends on the performance of the lamps and the fixture which, together with the ballast(s), make up a luminaire. This example shows the cost-effectiveness of efficient fluorescent ballasts used in combination with efficient lamps. The example also shows lifetime energy cost savings for the improved ballast, net of the savings from improved lamps. Each case evaluates energy use by a two-lamp ballast matched with appropriate lamps, selected to provide a similar level of light output.

The Base Model operates two 4-foot T12, 34 watt lamps, all at a base level of efficiency. The Recommended Level ballast operates two energy-efficient 4-foot T8, 32 watt lamps. The Best Available ballast operates two 4-foot T8, 32 watt lamps with the best available efficiency (see "How to Buy Energy-Efficient Fluorescent Tube Lamps").

Annual energy use is based on 3,600 operating hours/year. Lifetime energy costs and savings are based on a 15-year ballast life, during which three sets of lamps will be used. The assumed electricity price is 6¢/kWh, the federal average electricity price in the U.S.

Using the Cost-Effectiveness Table

In the example above, a ballast at the Recommended efficiency level is cost-effective if its price does not exceed the price of the Base Model ballast by more than $31. The Best Available ballast is cost-effective if its price is no more than $37 above the price of the Base Model ballast.

Metric Conversion

1 foot = 30.5 cm

What if my Electricity Price or Hours of Use are different?

To calculate annual or lifetime savings for a different electricity price, multiply the savings in the above table by this ratio: $\left(\frac{\textit{Your price in ¢/kWh}}{\textit{6.0 ¢/kWh}}\right)$. For different hours of use, multiply savings by this ratio: $\left(\frac{\textit{Your yearly hours of use}}{\textit{3,600}}\right)$.